# IBEX probe glimpses interstellar neighborhood

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LOS ALAMOS, New Mexico, January 31, 2012—Space scientists, including researchers from Los Alamos National Laboratory, today described the first detailed analyses of captured interstellar neutral atoms—raw material for the formation of new stars, planets and even human beings. The information was presented in Washington, D.C., at a press conference sponsored by the National Aeronautics and Space Administration (NASA).

Researchers at the conference presented data from the Interstellar Boundary Explorer (IBEX), which directly sampled material carried from outside our solar system across the galaxy by solar and stellar winds. Full details of the research comprise a six-paper special section in the February edition of *Astrophysical Journal Supplements*.

IBEX was launched in October 2008 and has maintained an elliptical orbit around Earth ever since. The space probe uses a pair of special cameras, one of which was

developed to a large degree at Los Alamos National Laboratory, to sample neutral atoms reaching Earth's surroundings from the edges of the solar system and its immediate neighborhood.

Earth is mostly shielded from direct bombardment by interstellar particles because the solar wind—a blast of charged particles emanating from the surface of the Sun—creates a protective bubble around us that deflects charged particles back into space. Without this bubble, called the heliosphere, Earth would be pummeled by cosmic radiation. IBEX provides the first global view of the outer boundary of this protective bubble.

IBEX also provides a direct sample of the surrounding neutral gas, which blows as an interstellar wind through the solar system.

"Interstellar particles are the raw stuff that form stars, planets, and even us," said Eberhard Moebius, a University of New Hampshire professor and IBEX team member currently on sabbatical at Los Alamos. UNH developed key systems of IBEX's second camera. "In the beginning there was only hydrogen and helium. These two elements formed the first stars. When those stars collapsed and died, they spewed their material, including new elements created through the process of nuclear fusion, out into space. We can tell a lot about the evolution of our universe and perhaps gain insight into other galaxies and planetary systems by analyzing these particles."

With the capacity to detect and analyze helium, hydrogen, neon, and oxygen, IBEX has been able to provide researchers with more information about our galactic neighborhood and raise some pressing questions about it. The IBEX research team has been able to characterize the ratio of oxygen to neon in Earth's present location and compare it to other data. The IBEX observations suggest that the ratio of neon to oxygen in material emanating from outside our solar system is larger than the ratio from within our solar system and also the Milky Way—our home galaxy—as a whole.

The ratio difference may suggest that the Sun's present location differs from its birthplace, or that a significant amount of oxygen might be bound up in grains of dust floating in interstellar space. Regardless of which hypothesis is correct, the IBEX mission findings are significant because this is the first time scientists have been able to gain direct quantitative measurements of the hydrogen, oxygen, and neon flow from outside our solar system, along with far more detailed observations of the interstellar helium flow.

Which leads to another interesting IBEX discovery:

The IBEX team has learned that the interstellar wind blows at about 52,000 miles per hour—about 7,000 miles an hour slower than previously measured.

IBEX takes advantage of a nature-provided "speedometer" for the interstellar wind by observing the degree of deflection of the gas on its journey into the solar system and past the Sun. The Sun's gravity deflects slower atoms to a stronger degree than it deflects faster atoms. IBEX is able to measure the flow direction in Earth's orbit with high precision, therefore providing the true speed and direction of the interstellar wind. With this tool, the researchers have been able to gain a better understanding of where Earth currently resides relative to known nearby clouds of interstellar material within our home planet's galactic neighborhood.

These nearby interstellar clouds are denser than the surrounding space and are moving at substantial speeds. Astronomers have measured the speed of many neighboring clouds and wondered about Earth's position among the closest clouds because the

previously known interstellar wind speed did not match with any of the closest clouds. However, the new IBEX observations place the solar system within what is called the Local Interstellar Cloud.

Astronomers tell us that Earth is traveling near the edge of this cloud and will leave it at any time within the next few thousand years—just the blink of an eye on astronomical time scales. When this occurs, the heliosphere, the protective bubble surrounding us, may expand significantly since it will be less constrained by the sparsely populated region it enters. On its journey roughly in the direction of the center of the Milky Way, Earth and our solar system will meander toward and into the next cloud over, called the G cloud (named for the cloud toward the galactic center).

Just three and a half years into the IBEX mission, at a time when the two Voyager spacecraft are due to exit the heliosphere within the next decade, who knows what other surprises researchers will uncover about our solar system and its immediate neighborhood? Only time will tell.

“How wonderful it is to see that some of the same technologies developed at Los Alamos National Laboratory for keeping our nation safe are being used to understand how Earth keeps itself safe from the turbulent forces of the universe and to gain a better understanding of our place in the galaxy,” said Los Alamos’s Herb Funsten, part of the original research team responsible for development of one of IBEX’s cameras.